Her Majesty's Stationery Office

The effects on Advertising Revenues of allowing Advertising on BBC Television

A Report for the Committee on Financing the BBC

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Introduction by the Chairman

I am glad to arrange for the publication of this important paper which is one of the research papers commissioned by the Committee.

Although the Committee is not due to report until the summer of 1986, I wanted to ensure that the main research was published in advance so that the independent advice which the Committee was receiving could be made generally available.

The views and opinions expressed in this report are those of the authors and do not necessarily represent those of the Committee.

Alan Peacock
Chairman
Committee on Financing the BBC

November 1985

Introduction and Summary

1. The aim of this study is to estimate the effect on advertising revenues of permitting BBC television to carry a limited amount of advertising. The study falls into two parts. Initially we assume that allowing advertising on BBC television is simply equivalent to increasing the overall supply of television advertising – in other words that the new opportunities made available to advertisers would not differ in any fundamental way from those currently available on ITV and Channel 4 – and make our projections on that basis. The second part examines this assumption by analysing in some detail the audience composition of programmes on the different channels; we conclude that in general it is justified.

2. The method adopted in the first part of the paper is to identify the factors which over the past twenty years have influenced spending on television and press advertising (in 1984 these two categories accounted for 94% of total advertising expenditure). We assume that the quantity of television advertising demanded depends upon the price of television advertising, the price of press advertising and on the level of activity in the economy (as measured by the gross national product – GNP). We make a similar assumption about demand for press advertising – that it too depends on the same three variables. We then use standard statistical procedures to estimate the quantitative impact of each of the three variables on the demand for television and press advertising.

3. The results were generally satisfactory. Those which we used to make the projections reported below were based on annual data for 1963–84. They suggest that the demand for advertising on the two media over this period was determined in the following way:

> a one per cent increase in GNP would immediately increase demand for television advertising by about one per cent, and press advertising by about two-thirds of a per cent; in the longer term, the effects would be rather greater;
>
> a one per cent increase in the price of television advertising would immediately reduce demand for it by about 0.4 per cent, and would increase demand for press advertising by about a quarter of a per cent; again, in the longer term, the effects would be rather greater;
>
> a one per cent increase in the price of television advertising would immediately reduce the demand for press advertising by about one per

cent, and increase the demand for television advertising by about 0.7 per cent; again, the long term effects are rather larger.

Three things are specially noteworthy about these estimates. First, demand for television advertising is relatively insensitive to its price. Second there is some substitution between press and television advertising, though not a great deal. Third, there are significant differences between short-run (current year) and long-run responses to a price change. These may reflect lags in advertisers' reactions to such changes, or other factors. It turns out that they have a significant effect on the projections given below.

4. We tried a number of other formulations in addition to those reported above (which we consider most satisfactory). Results using profit in place of GNP as an explanatory variable were not convincing. Quarterly data proved inadequate for estimation purposes. We also generated some results in which press advertising was disaggregated into advertising in National Newspapers, Regional Newspapers and (in some cases) Magazines and Business Periodicals. The statistical properties of these estimates were less satisfactory, however, and we do not feel justified in presenting projections based upon them.

5. Our next step is to use the results reported above to estimate what would have been the impact of allowing one minute's advertising per hour on BBC television (BBC1 and BBC2), in the circumstances prevailing in 1984. On our assumptions this is equivalent to increasing the supply of television advertising by 13.5 per cent and we use our results above to compute the fall in price of commercial time necessary to sell this increased quantity. We can thus estimate the change in total revenue from television advertising, the change in ITV and Channel 4 revenues, and the change in Press advertising revenues from such a change.

The results are shown in Table 1 (pages 22–23) and graphically in Figures 1 to 5 (pages 24–28), and can be summarised as follows. Because of the lag with which advertisers respond to a price change, there are differences between the short-run and long-run responses. We estimate that allowing one minute of advertising per hour on BBC television (and assuming no competitive reaction by the Press) would in the short run (the current year) reduce total television advertising revenue by 15 per cent (£185M), ITV and Channel 4 revenue by 25 per cent (£311M), and Press revenues by 7 per cent (£184M). The revenue generated for the BBC would be £126M. After three or four years, however, when the industry had had time to adapt, the changes would be: total television revenue down by 4 per cent (£44M); ITV and C4 revenue down by 15 per cent (£187M); press revenues down by 4 per cent (£115M); BBC revenue £143M.

If the press responded to the change by cutting its own advertising rates, in the manner in which it has responded to changes in television advertising rates in the past, then the initial impact of allowing one minute of advertising per hour on BBC television would be about the same, but there would be little subsequent recovery in television revenues (see Figures 1b and 2b): the long-run reduction in total television revenues would be about 13 per cent (£161M); the reduction in ITV and Channel 4 revenues about 23 per cent (£290M); the reduction in press revenues about 7 per cent (£180M); BBC revenue about £129M.

A gradual introduction of advertising on BBC television (15 seconds per hour in 1985, rising to 1 minute per hour in 1988) would generate the response pattern shown in Figures 3 and 4. The short term damage to revenues is less pronounced, but in the long run, the results are essentially the same as for an immediate introduction. Finally, Figure 5 shows the effect of combining a gradual introduction with the assumption that GNP grows from 1985 onwards at 2 per cent per annum (and the consequential increase in demand for television advertising).

6. The projections cited above illustrate quantitatively the effects of allowing one minute's advertising per hour on BBC television. The technique adopted is however only justifiable for a given range of increase and cannot be applied mechanically to much larger increases in advertising time available (say six minutes per hour). Our assumptions generate quantities of advertising outside the range actually observed in the sample period, but the prices we project fall well within the observed range, and this encourages us to place greater confidence in them.

7. Our projections can be adapted to incorporate quality differences between BBC audiences on the one hand and ITV and Channel 4 audiences on the other, provided that the quality differences can be reduced to quantitative terms. For example, if as a result of differences in audience composition or for any other reason, BBC audiences commanded a premium of say 20 per cent over ITV and Channel 4 audiences, then an unadjusted 10 per cent increase in the quantity of audience exposure caused by allowing advertisements on BBC television is equivalent to a quality-adjusted 12 per cent increase. The calculations can then proceed as before, after appropriate adjustments to the change in price and the division of revenues between BBC and independent channels. This procedure is legitimate provided that the range of BBC audiences does not differ from the range of ITV and Channel 4 audiences.

8. The second part of the paper is devoted to an examination of the characteristics of television audiences. Our approach is to analyse the various audiences available on the different channels in terms of a number of demographic and other characteristics, and to ask whether advertising on BBC television would allow advertisers access to audiences which are not currently available even after combining ITV and Channel 4 audiences by buying time on a number of different programmes. If BBC television audiences significantly extend the opportunities open to advertisers, then it ceases to be legitimate to aggregate advertising on BBC television with advertising on ITV and Channel 4.

9. To investigate this issue we analysed the detailed composition of audiences of the four channels during prime time on weekdays, Saturdays and Sundays.

We examined three types of characteristics: audience size, because large audiences are disproportionately efficient at obtaining a large reach (or access to a large proportion of the viewing population), and are thus disproportionately valuable; demographic characteristics, because advertisers naturally seek access to the audiences which buy their products; and viewing habits, because advertisers may place a specially high value on 'light ITV viewers' who are little exposed to television advertising at present.

10. The results indicated that in terms of average audience size BBC television programmes typically attract smaller audiences than ITV programmes. BBC audiences do differ from ITV and Channel 4 audiences in terms of demographic composition, both on average and to some extent in terms of extreme values. And not surprisingly BBC television audiences have a disproportionate representation of light ITV viewers. Nevertheless, allowing advertising on BBC television would only make limited additions to the range of audiences already available, and we conclude that the results of our study of audience characteristics justify the approach adopted in the first part of the paper. More tentatively we suggest that the differences in composition between BBC and ITV and Channel 4 audiences are consistent with BBC audiences trading at a premium if advertising were allowed on BBC television, but this element can be incorporated into the revenue projections in the way indicated in paragraph 7 above.

1. The Market Demand for Advertising and the Impact of Allowing an Increased Supply of Television Advertising

The first part of the paper is in two sections. The first describes what demand analysis with aggregate time series can tell us about the nature of demand for TV and press advertising. The second makes some projections – using the results in Section 1.1 – of how an increased supply of TV advertising would influence the prices of TV and press advertisements and the revenues from these advertisements. The discussion in the first section is inevitably rather technical in places, and the reader may wish to skim over this section; the most important results are given in sub-sections b(ii) and v(vii).

1.1 **Demand Analysis with Aggregate Data**

(a) Preliminaries

There are a few preliminary issues that need to be discussed here.

(i) The 'Complete System' and the 'Gross' Demand Function

In the complete system approach to demand analysis, demand for a particular category of advertising is modelled as a function of the total (real) expenditure on all types of advertising, and the prices of the different categories. This approach can be rather efficient, essentially because the advertising is seen as a separable group of expenditures, and the various restrictions of demand analysis (Engel aggregation, Cournot aggregation, homogeneity, symmetry and negativity) can be used to reduce the parameter set to be estimated. Moreover, such an approach circumvents the problem of what constitutes the appropriate 'income' variable to use in 'gross' demand analysis – see (v) below.

Nevertheless, there is a serious problem with such demand equations if we wish to answer the sort of 'what if' questions that we shall try to answer in Section 1.2. To find out what would happen to the market clearing price for TV advertising if supply were increased, we have to make some assumption about what happens to total (real) expenditure on all types of advertising. It is hardly acceptable to assume it stays constant; such an assumption will prejudice any answer we might hope to obtain from the data about what happens to total advertising revenues. In short, we are obliged to add on to this complete system model some model of how total (real) advertising expenditures depend on the prices of the various types of advertising (or some overall index).

While we did make some preliminary estimates of complete system equations, we considered it preferable to estimate 'gross' demand functions showing how demand for the various types of advertising depends on some measure of total income and the various prices. It is much easier to use such 'gross' functions to answer 'what if' questions, as it is quite reasonable to assume that an increase in the total supply of advertising has a negligible effect on (any measure of) national income – the question of the appropriate income measure is discussed below (v). Moreover, the practical value of micro-restrictions (homogeneity etc) with macro data is a matter of some doubt.

(ii) Equation Dynamics

Much of the work of demand analysis – especially complete systems of demand equations – has paid little attention to the dynamics of the demand equation. This stands in contrast to the work in most other areas of applied econometrics where dynamic specification is perhaps the most important issue. Moreover, there is some evidence that the very frequent rejection of homogeneity in complete systems of demand equations may be a result of inadequate attention to dynamics.

The modelling strategy adopted throughout is one of 'intended over-parameterisation with data-based simplification' – Hendry and Mizon (1978). We introduce first order AR and MA dynamics into the demand equations, though it has to be said that this may not completely summarise the dynamic behaviour of the advertising expenditure time series.

(iii) Simultaneity in Demand Equations

The nature of the auction for TV time – see Cave (1985) – suggests that random shocks in demand would very probably lead to corresponding adjustments to prices of TV advertising, and therefore that the prices in demand equations might not be weakly exogenous. To analyse this question, we examine what might be called the Frisch-Kalman diagnostics – see Swann (1985b) – and also estimate 2SLS versions of the demand equations using a variety of instruments including lagged prices. The conclusion seems to be that by either measure, simultaneity is probably not an unduly serious source of bias when compared to the sampling uncertainty inherent in estimates based on such a small sample.

(iv) The Data

We can take as our unit of quantity the exposure of a (say) a thousand viewers to (say) a thirty second commercial – such exposure figures are found from audience data. The price index for TV advertising is computed by dividing total TV advertising revenues by the quantity measure; this is the average price of reaching a thousand viewers for thirty seconds.

In the more highly aggregated categories, press advertising is defined as all advertising in national and regional newspapers, magazines and periodicals (including trade press and professional journals), and business directories. In the less aggregated categories, press advertising is broken into three parts:

(1) national newspapers; (2) regional newspapers; (3) magazines, periodicals, professional journals. Advertising on posters, public transport, cinema, and radio are neglected, since they account for only a small proportion of all advertising.

The price data are the AA indices of media rates as given in the 1985 *Advertising Association (AA) Yearbook;* the corrected series for press rates is used. The quantity data come from the same source. For a detailed description of these data, reference is made to the AA Yearbook.

It was necessary to introduce a dummy variable to take account of the 1979 ITV strike which significantly reduced the level of TV advertising below what it would otherwise have been. While it is hardly appropriate to treat this as a special condition affecting the demand function, the dummy variable can simply be taken to indicate that the demand curve does not operate in that particular year.

There remains the issue of what is the appropriate income variable for the demand equation. There seem to be two schools of thought on this: first, that the appropriate measure at the micro level is company turnover, so that at the macro level it should be something like GNP (or GDP, though GNP was in fact chosen); second, that for a postponable investment such as advertising, current profits are the crucial determinant. There is a problem with the latter, that such a rule for advertising expenditures is particularly destabilising. Nevertheless, we have examined both, and find that there is some support for either model of advertising expenditures, but on balance the model based on GNP is probably the more reliable. The GNP data (in constant prices) come from the Blue Book as does the appropriate deflator.

Finally, we have experimented with annual data from 1963 to 1984 (22 observations) and quarterly data from 1978:1 to 1984:4 (28 observations). There are several problems with the quarterly data, most important that while TV advertising prices are available on quarterly basis, press advertising prices are not. The result is that the quarterly estimates do not seem particularly reliable compared to the annual estimates.

(b) Results

The results can be organised under seven headings: (i) complete system results; (ii) gross demand equations; (iii) simultaneity and 2SLS estimates; (iv) disaggregated results (3 and 4 categories); (v) results using profits as an 'income' variable; (vi) results using quarterly data; (vii) Bertrand reaction curves – the motivation for these is described in Section 1.2 below.

The following mnemonics define the variables used in the analysis:

ATV: TV advertising in constant (1980) prices
APR: (All) Press advertising in constant (1980) prices
ATOT: Total Advertising in constant (1980) prices
PTV: Price of TV advertising (1980 = 100)
PPR: Price of (All) Press advertising (1980 = 100)

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GNP: Gross National Product in constant (1980) prices
PGDP: GDP deflator (1980=100)
PTV: PTV/PGDP (ie real price)
PPR: PPR/PGDP (ie real price)
D79: A dummy for the 1979 ITV strike (D79=1 in 1979, D79=0 elsewhere)

(i) Complete Systems of Demand Equations

The complete system was estimated for the two categories only – TV advertising and (all) press advertising. The form of demand equation used was the double-log. This has the shortcoming that it does not satisfy the adding-up criterion – see Deaton and Muellbauer (1980) – but on the other hand, it is very convenient as it offers a constant price elasticity. The results for the most general model of TV advertising were as follows; figures in parentheses under parameter estimates are parameter standard errors, and P(1) is the Box-Pierce test for autocorrelation (first order) distributed as chi-squared (1). (One observation is lost as a result of introducing the lagged variables.)

$$\begin{aligned} \ln(ATV_t) = & \underset{(.49)}{-.78} - \underset{(.16)}{.45} \ln(PTV_t) + \underset{(.18)}{.07} \ln(PTV_{t-1}) + \underset{(.22)}{.46} \ln(PPR_t) \\ & + \underset{(.33)}{.02} \ln(PPR_{t-1}) + \underset{(.13)}{.63} \ln(ATOT_t) - \underset{(.27)}{.32} \ln(ATOT_{t-1}) \\ & + \underset{(.29)}{.42} \ln(ATV_{t-1}) - \underset{(.03)}{.19} D79_t + \underset{(.07)}{.05} D79_{t-1} \end{aligned}$$

$R^2 = .986$ $T = 19$ (1964–82)
$SE = .026$ $P(1) = 0.07$ $df = 9$

The results for the most general model of press advertising were as follows:

$$\begin{aligned} \ln(APR_t) = & \underset{(.07)}{-.20} - \underset{(.08)}{.23} \ln(PPR_t) + \underset{(.13)}{.00} \ln(PPR_{t-1}) + \underset{(.05)}{.22} \ln(PTV_t) \\ & \underset{(.07)}{-.04} \ln(PTV_{t-1}) + \underset{(.05)}{1.09} \ln(ATOT_t) - \underset{(.31)}{.33} \ln(ATOT_{t-1}) \\ & = \underset{(.29)}{.35} \ln(APR_{t-1}) + \underset{(.03)}{.06} D79_t - \underset{(.07)}{.01} D79_{t-1} \end{aligned}$$

$R^2 = .996$ $T = 19$ (1964–82)
$SE = .009$ $P(1) = 0.02$ $df = 9$

The key points to note from these regressions are as follows. First, the short run price elasticities appear to be roughly equal and opposite – this would be consistent with homogeneity in the demand equation. Secondly, the lagged terms have relatively small coefficients, especially the lagged price coefficients. Thirdly, the 1979 dummy seems to play quite an important role, suggesting that the 1979 strike reduced TV advertising some twenty per cent below what it would otherwise have been. Fourthly, by the Frisch-Kalman diagnostics – see Swann (1985b) – the t-statistics are well above df/4 for the most important parameters, suggesting that sampling error is probably more important than non-sampling errors in these estimates. Finally, the critical levels of measurement error for the price terms are reasonable, if a little low for comfort–in the region of plus or minus ten per cent for the two contemporaneous price variables.

Following the strategy of 'intended over-parameterisation with data-based simplification', various simplifications to these models were examined. Three general approaches were adopted: (1) dropping lag terms; (2) imposing homogeneity of price effects; (3) using first difference operators.

The general conclusions are broadly the same for both types of advertising. Dropping lag terms is acceptable, except for the lagged endogenous variable; models with no dynamics whatever show serial correlation, which is a further argument in favour of keeping at least some limited dynamics. Conditional on the models with no lags the homogeneity restrictions is in both cases firmly rejected, while conditional on the general model homogeneity is acceptable for TV advertising though not for press advertising. This confirms what we noted above that the combination of homogeneity and no dynamics is particularly difficult to accept on the available data. First difference specifications are statistically acceptable, though we do not consider them to be natural economic hypotheses. The statistical acceptability is perhaps just an indication that a test based on such a small sample is rather weak.

The complete system results are from a statistical point of view rather good, and indeed rather better than the 'gross' equations as we shall see below. However, we do–as argued above–consider that the complete system equation is not really suitable to answer our 'what if' questions. For that reason, we are really obliged to look at estimates of 'gross' demand functions.

(ii) 'Gross' Demand Functions

The same modelling strategy was adopted here. As before, it was generally acceptable from a statistical point of view to reduce the most general models to models with lags on the endogenous variable only; such models are just about as useful as the most general models, and for some of the projections the general models are used, while for others these reduced models are used.

The form of the gross equations is slightly different, in as much as the prices are deflated by the GDP deflator (and denoted by $P\tilde{T}V$, $P\tilde{P}R$). And of course, GNP (in real terms) is used in place of ATOT. These models were first estimated for the period 1964 to 1982–one observation (1963) is lost because of the lagged variables in the equation. The prediction errors for 1983 and 1984 were negligible, and no systematic bias appeared with an overprediction for one year and an underprediction for the other. This is quite important, as these years contain Channel 4 advertising for the first time. We consequently proceeded to estimate these models for the longer period 1964–84, and these are the results presented here. Using the same notation as before, the estimates for the two categories of advertising are as follows:

$$\ln(APR_t) = \underset{(1.92)}{-5.99} - \underset{(.16)}{.44}\ \ln(P\tilde{T}V_t) + \underset{(.18)}{.09}\ \ln(P\tilde{T}V_{t-1}) + \underset{(.28)}{.70}\ \ln(P\tilde{P}R_t)$$

$$+ \underset{(.38)}{.35}\ \ln(P\tilde{P}R_{t-1}) + \underset{(.58)}{1.20}\ \ln(GNP_t) - \underset{(.71)}{.20}\ \ln(GNP_{t-1})$$

$$+ \underset{(.22)}{.56}\ \ln(ATV_{t-1}) - \underset{(.04)}{.23}\ D79_t + \underset{(.07)}{.08}\ D79_{t-1}$$

$R^2 = .960$ $T = 21$ (1964–84)
$SE = .033$ $P(1) = 0.00$ $df = 11$

$$\ln(APR_t) = \underset{(1.56)}{-2.43} - \underset{(.44)}{.64}\ \ln(P\tilde{P}R_t) + \underset{(.55)}{.05}\ \ln(P\tilde{P}R_{t-1}) - \underset{(.24)}{.35}\ \ln(P\tilde{T}V_t)$$

$$+ \underset{(.31)}{.51}\ \ln(P\tilde{T}V_{t-1}) + \underset{(.77)}{3.21}\ \ln(GNP_t) - \underset{(.85)}{2.45}\ \ln(GNP_{t-1})$$

$$+ \underset{(.33)}{.22}\ \ln(APR_{t-1}) + \underset{(.05)}{.05}\ D79_t + \underset{(.07)}{.12}\ D79_{t-1}$$

$R^2 = .904$ $T = 21$ (1964–84)
$SE = .045$ $P(1) = 0.01$ $df = 11$

With a couple of exceptions, the point estimates of the parameters look reasonably sensible. The key points to note from these regressions are as follows. First, the short run price elasticities do not now appear to be equal and opposite, which is slightly surprising. Indeed, there is some rather peculiar short term behaviour with respect to TV advertising prices in the press advertising demand equation, though the long run behaviour is sensible enough. In the light of this, we prefer to simplify the dynamics of the equation for press advertising, or otherwise we will obtain some curious results for the projections in Section 1.2.

Secondly, and related to this, we observe that while some of the lagged terms have relatively small coefficients, this is not true of all lag coefficients. Statistically speaking, the 'parsimonious' model presented below (which drops all lags except the lagged endogenous variable) is an acceptable restriction on the general model for the TV advertising equation – with F(4,11) = 1.2. Strictly speaking however, it is not an acceptable restriction on the press advertising equation – with F(4,11) = 5.4. However, an intermediate version of the press advertising equation with no lagged prices is a statistically acceptable restriction on the general model (note that the t-values that attach to the lagged prices are below 2), and it generates price elasticities (which are after all the important parameters here) that are very similar to those in the 'parsimonious' equation.

Thirdly, the 1979 dummy again suggests that the 1979 strike reduced TV advertising some twenty per cent below what it would otherwise have been.

Fourthly, by the Frisch-Kalman diagnostics – see Swann (1985b) – the t-statistics for contemporaneous prices are of similar magnitude to df/4 in the TV equation suggesting that non-sampling error need be no more important than sampling errors in these estimates. The position is not quite so good for the press equation, which has throughout our analysis proved to be the less reliable.

Finally, the critical levels of measurement error for the price terms are a little low for comfort – in the region of plus or minus six per cent for the contemporaneous TV advertising price, and rather less for the press advertising price.

The reduced models were estimated as follows:

$$\begin{aligned}\ln(ATV_t) = &- \underset{(1.24)}{5.88} - \underset{(.11)}{.24}\ \ln(P\tilde{T}V_t) + \underset{(.27)}{.58}\ \ln(P\tilde{P}R_t)\\ &+ \underset{(.22)}{1.07}\ \ln(GNP_t) + \underset{(.15)}{.36}\ \ln(ATV_{t-1}) - \underset{(.04)}{.23}\ D79_t\end{aligned}$$

$R^2 = .958$ $\qquad\qquad$ $T = 21$ (1964–84)

$SE = .034$ $\qquad$ $P(1) = 1.02$ $\qquad$ $df = 15$

$$\begin{aligned}\ln(APR_t) = &-\underset{(1.52)}{1.35} - \underset{(.52)}{.95}\ \ln(P\tilde{P}R_t) + \underset{(.20)}{.26}\ \ln(P\tilde{T}V_t)\\ &+ \underset{(.28)}{.67}\ \ln(GNP_t) + \underset{(.15)}{.08}\ \ln(APR_{t-1}) + \underset{(.07)}{.05}\ D79\end{aligned}$$

$R^2 = .791$ $\qquad\qquad$ $T = 21$ (1964–84)

$SE = .066$ $\qquad$ $P(1) = 3.53$ $\qquad$ $df = 15$

The main difference to note between these results and those for the most general models are the rather lower parameter standard errors, and the correspondingly higher critical levels of measurement error – in the region of plus or minus eight per cent for the TV advertising price. It is also worth noting that the press equation shows some sign of first order autocorrelation.

(iii) Simultaneity and 2SLS Estimates

Given the possibility of simultaneity bias, we carried out some experiments to estimate the gross demand equations using 2SLS with suitable instruments. The first were supposedly (weakly) exogenous variables such as total TV licences and press circulation figures (as measured by real consumer expenditure on newspapers, magazines and periodicals). The second were simply lagged values of the possibly endogenous price variables – the use of this latter kind of instrument did of course preclude the estimation of full models with current and lagged price effects, which would now be unidentified.

Experiments using 2SLS with the first set of instruments were most unsatisfactory, essentially because the first stage of 2SLS produced predictors of such low quality that the parameter standard errors for the 2SLS estimates were extremely high, so high indeed, that no inferences could really be made. The experiments based on lagged prices as instruments were much more successful, with only a slight increase in equation standard errors over and above those for OLS.

The differences between these latter 2SLS estimates and the OLS estimates were really very minor. This is rather reassuring, and would suggest that simultaneity bias may not be unduly important. As we noted above, such a conclusion is supported by the Frisch-Kalman diagnostics for the OLS estimates.

(iv) Disaggregated Results (3 and 4 categories)

In addition to the two category demand equations, we have also attempted to analyse three and four category systems – the three category system includes TV, National Newspapers, and Regional Newspapers, while the four category system includes these three and also Magazines and Business Periodicals. As well as the intrinsic interest of examining demand at a greater degree of disaggregation, such estimates would allow us to be more specific about the revenue effects analysed in Section 1.2. On the other hand, the disadvantage of demand analysis with more categories is that we are left with much less partial variation in the prices in our demand equations, and as is often the case in larger systems, the reliability of our results falls as the number of categories (and so prices in each equation) increases.

In the three category system, the equations for TV and Regional Press advertising were reasonably credible, but that for National Press advertising is not. The implication would seem to be that the close relation between regional and national press advertising prices so reduces the partial variation in these three category equations – the parameter standard errors were much increased – that at least as far as the National Press equation is concerned, we would be stretching the data too far if we try to make inferences about demand at this level of disaggregation.

The critical level of measurement error for the press advertising prices in the national press equation are in the region of plus or minus 3 per cent, and in view of the impossibility of measuring the true price per reader 'exposure' to press advertisements, the actual measurement errors for press advertising prices could well be of this order. We have reason to expect, however, that the TV advertising prices should be much more accurate as it is possible to measure this price per viewer exposure to an advertisement. We should in conclusion note that unreliability of this sort is not an uncommon problem with any medium to large system of demand equations.

(v) Results Using Profits as an 'Income' Variable

The majority of microeconomic studies of advertising expenditure at the firm level (see for example those summarised in Koutsoyiannis (1982) and Chiplin and Sturgess (1981)), model advertising as a function of the firm's activity or turnover. At an aggregate level, some measure of total activity would therefore seem appropriate. Subject to the usual aggregation problems and the possible dangers of including inappropriate aspects of economic activity, we have modelled aggregate advertising expenditure as a function of real GNP.

Nevertheless, it could be argued – see for example the discussion in Lind (1979/80), though Lind himself does not necessarily subscribe to the argument – that for a postponable investment, what is more important than activity is cash flow. By this argument, the appropriate 'income' measure for the demand equation is some measure of total profit. We would make two points about this. First, it would be appropriate to view advertising expenditure as a postponable investment if advertising is treated as a stock, but while many economists view it as a stock (with a high decay rate), many non-economists do not. Second, from the perspective of a managerial economist, a decision rule that determines advertising on the basis of current profitability seems a bit suspect: if low profitability is a result of uncompetitiveness, then a reduction in advertising will only serve to make the position worse. In short, such a decision rule may give a destabilising rather than a stabilising role to advertising.

We do not report the estimated equations for the two category system with profits in place of income; they suggest a similar response of TV advertising to prices, but a more complex response of press advertising to prices. Moreover, the 'income' elasticity of advertising expenditure is rather lower in this case.

As far as the 'what if' questions of Section 1.2 are concerned, the price and revenue effects in the absence of any competitive reaction will be of a similar magnitude whether we use these parameters or those in (ii) above. In that sense, the differences are not particularly important. If, however, we wish to analyse price and revenue effects in the presence of competitive reaction, the answers will depend on which set of parameters we use. It seems fair to say that those based on the parameters in (ii) are more credible and probably more reliable.

(vi) Results Using Quarterly Data

We did make some estimates using quarterly data, but these were really most uninformative. There were two initial problems. First, there were only observations for 1978–84, and with the greater dynamic complexity necessary to model quarterly data, there were barely sufficient data to estimate an 'intentionally overparameterised' model. Second, and more serious, there is no published quarterly series for press advertising prices. While it is possible to generate an interpolated series, this is really rather suspect, especially if there is a seasonal dimension to the series – as there is for TV advertising prices. (We note in passing that there is no point in imposing this latter pattern on the press price, for that would be lost when we calculate the partial variation in each price.)

The estimates assumed that the press price was the same in each quarter–in other words, we simply used the annual series as a quarterly series. The resulting point estimates were rather volatile, and moreover the estimated standard errors were very large indeed–over one for the press advertising prices. In this sense, we consider that the estimates are simply not at all informative: they do not reduce the range of statistically acceptable parameters.

(vii) Bertrand Reaction Curves

The final piece of econometric estimation was to examine Bertrand reaction functions for the press prices. The motivation for these functions will be explained in the next section. We estimated appropriate functions corresponding to the two, three, and four category demand equations. As before, the results for the two category system were most reliable, and as we only use the two category system in the projections presented below, these are the results we report here.

Using the previous notation, the reaction function for the press advertising price depends on the TV advertising price and GNP as follows:

$$\begin{aligned} \ln(P\tilde{P}R_t) = \underset{(.47)}{-.21} + \underset{(.09)}{.17}\ \ln(P\tilde{T}V_t) - \underset{(.09)}{.06}\ \ln(P\tilde{T}V_{t-1}) \\ + \underset{(.24)}{.55}\ \ln(P\tilde{P}R_{t-1}) - \underset{(.29)}{.23}\ \ln(GNP_t) + \underset{(.26)}{.27}\ \ln(GNP_{t-1}) \end{aligned}$$

$R^2 = .620$ $T = 21$ (1964–84)
$SE = .024$ $P(1) = 0.15$ $df = 15$

The results suggest a perceptible if not very strong competitive reaction in press advertising prices to any adjustment in TV prices. It must be added, however, that there could be simultaneity bias here, and that we may be identifying some mixture of the two Bertrand reaction functions for the two advertising prices. This is something which does ideally need further research.

1.2 The Impact on Prices and Revenues of Allowing an Increased Supply of TV Advertising

In this section, we use our estimates of demand for TV and Press advertising along with the estimated reaction curves to make some projections of what effect an increase in supply of TV advertising would have on the prices of advertisements of the two types, the demand for those two types of advertisement, and consequently the advertising revenues of television and the press. We proceed by asking what adjustment to price is required to persuade the market to buy the additional supply of TV advertising. If demand for TV advertisements is price elastic, relatively small reductions to the price of TV advertisements will clear the market, while if that demand is price inelastic, then relatively large reductions in price are needed.

First, in part (a) we spell out the assumptions required to make these projections, and then in part (b) we present what we consider to be our 'most likely' projections. The projections are the most realistic estimates that we can obtain from the available data, but they must be regarded as tentative. Relatively small changes in some of the parameters, notably the autoregressive parameters in the demand equations, can make relatively large changes to the projections; this is not a defect of our analysis, but is inherent in the mathematical structure of the models and cannot be avoided without distorting the demand equations in an unacceptable way.

(a) Assumptions

We assume that it is sensible to talk of aggregate concepts such as the quantity of TV advertisements, the quantity of press advertisements, and their corresponding prices. Naturally, these aggregates contain a wide variety of types, but that does not necessarily invalidate the aggregate demand analysis so long as the standard aggregation conditions are satisfied – Deaton and Muellbauer (1980) give a comprehensive summary of these. Probably the most important issue here is whether it is valid to treat advertising to BBC audiences as the same group of commodities as advertising to ITV and Channel 4 audiences, for this is what we need to assume in order to make the projections of this section. In Section 2 we make a very careful examination of this assumption, and find that in the sense required for the projections below, BBC audiences do not represent a markedly different *range* of commodities – even if on the average they are rather different.

There are three other issues that should be discussed here.

(i) Market Clearing

We assume that following an increase in supply, the price of TV advertisements adjusts as necessary to clear that market. It is difficult to see how any progress could be made without this assumption. If there is excess demand at the going price such that the buyers are not on their demand curve, then we cannot be clear about what would happen to price. Alternatively, if an increase in supply is not bought, then it does not generate any revenue, and the whole exercise becomes pointless.

(ii) The Supply of TV Advertising

It may appear to be implicit in our procedure that we analyse a rightward shift in a completely inelastic supply curve for TV advertising, and such an analysis might be thought suspect on the grounds that this supply is not completely inelastic. This is a rather confusing point, and really involves two issues. First, does our procedure really assume an inelastic supply? From one perspective it does; if we say "this is what the total supply of TV advertising will be if so many minutes per day are allowed on the BBC, and this is what happens to price", then it is implicit in the projections that the supply of ITV advertising is unchanged (and so inelastic to the reduction in price). From another perspective it doesn't; if we treat the projections as answers to the question "what adjustment must be made to price if an increased supply is to be sold", then we are simply estimating points on a demand curve, and the elasticity of supply does not enter into our analysis.

Secondly, is the assumption of an inelastic supply of ITV advertising necessarily wrong? With a fixed (and binding) maximum for advertising time on ITV and an unchanged audience, the supply of ITV advertising cannot increase in response to changes in price. It can decrease, however, and a simple Cournot reaction curve might suggest that the ITV reduce its supply in response to the introduction of advertising on the BBC.

It is probably safest, therefore, to interpret the projections as estimates of whether there is scope for raising further revenue for broadcasting by increasing the supply of TV advertising, rather than a precise statement about the outcome of the competitive process between the ITV and the BBC if the latter were to take advertising.

(iii) Competitive Reactions in Press Advertising Prices

In the demand equations presented in Section 1.1, demand for each of the two advertising categories depended on the price of that category, and the price of the rival medium. The reduction of the TV advertising price resulting from the increased supply would undermine the market for press advertising, and a competitive reduction in price could be expected. For this reason, we present two sets of projections–one based on no competitive reduction in press advertising prices, and a second based on a process of mutual price reactions as suggested by the TV advertising demand function and the reaction curve estimated in the previous section.

(b) The Results

An almost unlimited number of projections could be presented corresponding to different increases in supply, different assumptions about competitive reaction, different time-scales (short-run versus long run), different degrees of disaggregation, and the (slightly) different estimates obtained from full models and 'parsimonious' models. A wide range of projections obtained in this way would be utterly bemusing, and we confine our attention to a few illustrative projections. Simulation models to explore the various assumptions have been developed to run under Lotus 1-2-3 (on an IBM Personal Computer), and are available from the authors on request.

We explore the implications of allowing one minute per hour throughout the day on BBC1 and BBC2. Assuming that (viewer for viewer) the audiences are of equal value to advertisers – on this see Section 2.1, and assuming that the ITV/BBC audience split remains at 55%/45%, this is equivalent to a 13.5 per cent increase in the supply of TV advertising. We compare what would happen if this amount of advertising were introduced immediately with what would happen if it were introduced gradually.

To help focus on the pure effects of a step change in supply, it is really easiest to conduct the simulation in a 'quasi-static' context where GNP is fixed, and where we analyse the movement from one stationary state to another. The assumption of no GNP growth may however seem a little perverse at first sight. Even the most pessimistic macroeconomic forecaster would expect some growth in GNP, and given a short-term income elasticity of demand for TV advertising of about one (see above – the long-term elasticity is rather higher), it would seem reasonable to expect that some growth in advertising from year to year could be absorbed by the market without any reduction in price. We have therefore carried out a simulation of the gradual introduction of advertising on the BBC in the presence of a two per cent growth rate of GNP. The problem with this, of course, is that this simulation does not reach a new stationary state: GNP goes on growing while advertising supply does not. For this reason, it is interesting to examine the steady state growth path properties of the model; then we can answer the question, "For any given growth rate for GNP, what rate of growth of advertising can the market absorb without depressing prices?"

The results presented here use the regression estimates from the 'full' equation for TV advertising and the 'parsimonious' equation for press advertising (Section 1.1(b)). Those which make no allowance for competitive reaction in press advertising prices simply use the TV advertising equation to predict the path of TV advertising prices. Then it is a simple matter to evaluate the effect on TV advertising revenues, and (via the cross price elasticity of demand for press advertising with respect to the price of TV adverts) the effect on press advertising revenues. As a technical point, it can be shown that the prices and revenues are ARMA(1,1) processes in the quantity of TV advertising.

The results which do allow for competitive reaction are the solution to a two equation dynamic model. In the first instance, TV advertising prices depend on supply through the TV advertising demand equation, but this price causes a competitive reaction (part contemporaneous, part lagged) in the press advertising price, which in turn influences the market clearing value for TV advertising prices. The solutions to this simultaneous model are ARMA(2,2) processes for both prices, which can be used as before to generate revenue effects.

Finally, we note that the projections assuming a continuing growth of GNP have to be terminated at some arbitrary point; we have chosen 1988, when the assumed gradual introduction is complete.

The projections are summarised in Table 1 (which also shows the revenue effects in £Mn (1984 prices)), while the accompanying figures give a more detailed picture of the paths taken by the variables of interest. Figure 1a shows the time paths for TV advertising price and revenue following an immediate increase in advertising, and assuming no competitive reaction (the variables are expressed as percentages of their base levels). Note that the path for ITV and C4 revenues is the same as that for the price since the supply of advertising on ITV and C4 is assumed to remain constant.

Table 1
Projections of Prices and Revenues

(A) Immediate Introduction of 1 minute per Hour on BBC (1 and 2)
No subsequent growth in advertising on BBC
No GNP growth
Quantity of advertising on ITV and C4 fixed at 1984 level
The estimates abstract from any general inflation in prices

(i) Percentage changes from 1984 base

	No Reaction from Press		With Reaction from Press	
	Short Run	Long Run	Short Run	Long Run
TV Advertising				
Quantity	13.5%	13.5%	13.5%	13.5%
Price	–25%	–15%	–25%	–23%
Revenue	–15%	–4%	–15%	–13%
ITV+C4	–25%	–15%	–25%	–23%
BBC				
Press Advertising				
Quantity	–7%	–4%	–3%	–1%
Price	0%	0%	–5%	–6%
Revenue	–7%	–4%	–7%	–7%

(ii) 1984 Base and Absolute Revenue Changes
(Figures are in current £M)

		No Reaction from Press		With Reaction from Press	
	Initial	Short Run	Long Run	Short Run	Long Run
TV Advertising					
Revenue	1245	–185	–44	–185	–161
ITV+C4	1245	–311	–187	–311	–290
BBC	0	126	143	126	129
Press Advertising					
Revenue	2558	–184	–115	–190	–180

(B) Gradual Introduction of Advertising on BBC (1 and 2):
15 secs by 1985; 30 secs by 1986; 45 secs by 1987; 1 minute by 1988.
No subsequent growth in advertising on BBC
No GNP growth
Quantity of advertising on ITV and C4 fixed at 1984 level
The estimates abstract from any general inflation in prices

(i) Percentage changes from 1984 base

	No Reaction from Press		With Reaction from Press	
	Short Run	Long Run	Short Run	Long Run
TV Advertising				
Quantity	3.4%	13.5%	3.4%	13.5%
Price	–7%	–15%	–7%	–23%
Revenue	–4%	–4%	–4%	–13%
ITV+C4	–7%	–15%	–7%	–23%
BBC				

Table 1
Projections of Prices and Revenues
(contd.)

	No Reaction from Press		With Reaction from Press	
	Short Run	Long Run	Short Run	Long Run
Press Advertising				
Quantity	–2%	–4%	–1%	–1%
Price	0%	0%	–1%	–6%
Revenue	–2%	–4%	–2%	–7%

(ii) 1984 Base and Absolute Revenue Changes
(Figures are in current £M)

		No Reaction from Press		With Reaction from Press	
	Initial	Short Run	Long Run	Short Run	Long Run
TV Advertising					
Revenue	1245	–52	–44	–52	–159
ITV+C4	1245	–91	–187	–91	–288
BBC	0	39	143	39	129
Press Advertising					
Revenue	2558	–50	–115	–52	–178

(C) Gradual Introduction of Advertising on BBC, Plus GNP Growth
15 secs by 1985; 30 secs by 1986; 45 secs by 1987; 1 minute by 1988
No subsequent growth in advertising on BBC
GNP growth of 2 per cent p.a. from 1985
Quantity of advertising on ITV and C4 fixed at 1984 level
The estimates abstract from any general inflation in prices

(i) Percentage changes from 1984 base

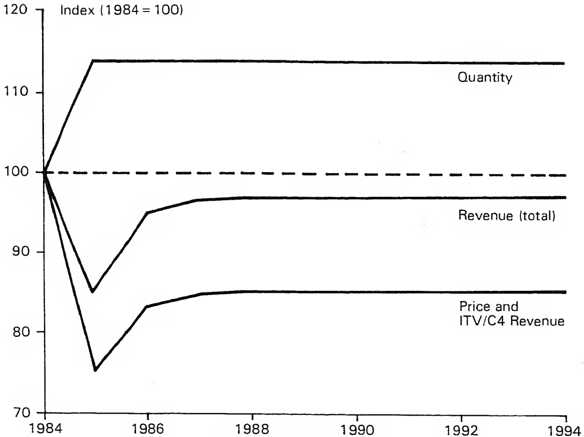
	No Reaction from Press		With Reaction from Press	
	Short Run	Long Run (1988)	Short Run	Long Run (1988)
TV Advertising				
Quantity	3.4%	13.5%	3.4%	13.5%
Price	–2%	2%	–3%	0%
Revenue	1%	16%	0%	13%
ITV+C4	–2%	2%	–3%	0%
BBC				
Press Advertising				
Quantity	1%	6%	1%	7%
Price	0%	0%	–1%	–1%
Revenue	1%	6%	1%	6%

(ii) 1984 Base and Absolute Revenue Changes
(Figures are in current £M)

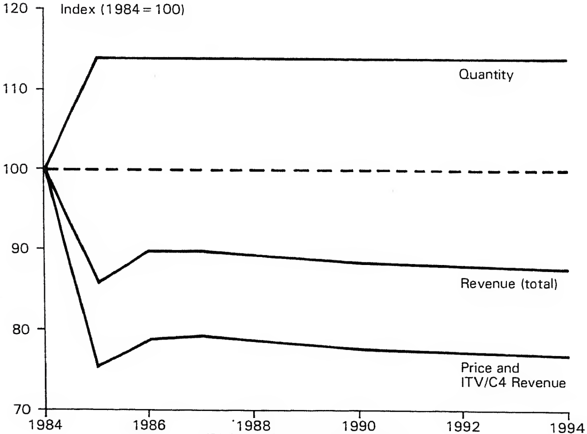
		No Reaction from Press		With Reaction from Press	
	Initial	Short Run	Long Run	Short Run	Long Run
TV Advertising					
Revenue	1245	14	200	5	162
ITV+C4	1245	–27	28	–36	–5
BBC	0	41	172	41	167
Press Advertising					
Revenue	2558	19	165	13	146

Note: With a continuing growth of GNP, but no further growth in TV advertising, this forecast cannot stabilise at a new stationary state. For this reason, it is necessary to choose an arbitrary date at which to terminate the forecast. In this table, we stop at 1988; this is when the gradual introduction is complete.

Figure 1:
TV Advertising – Immediate Introduction

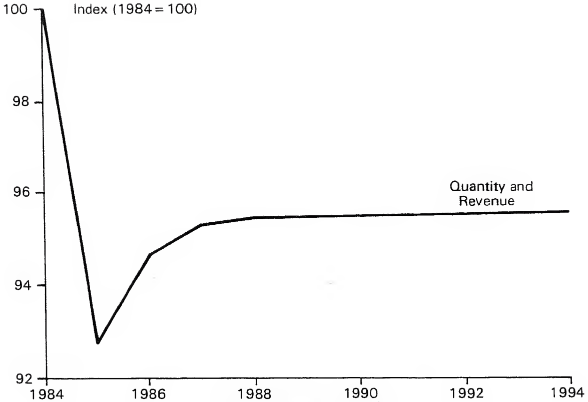


(A) No Competitive Reaction

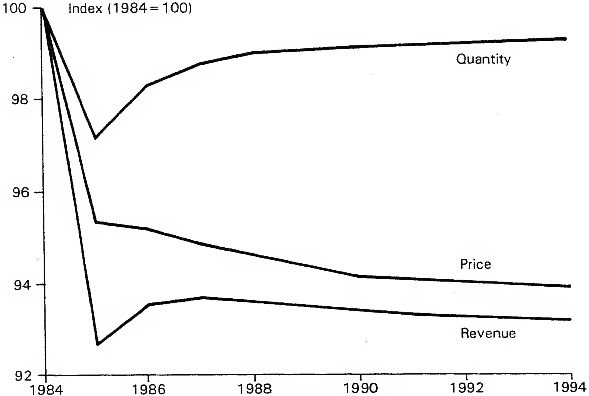


(B) Some Competitive Reaction

Figure 2:
Press Advertising – Immediate

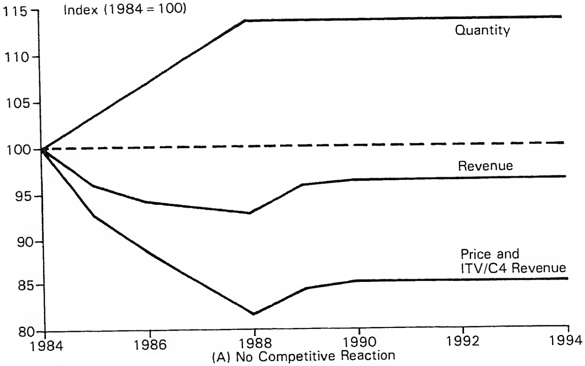


(A) No Competitive Reaction

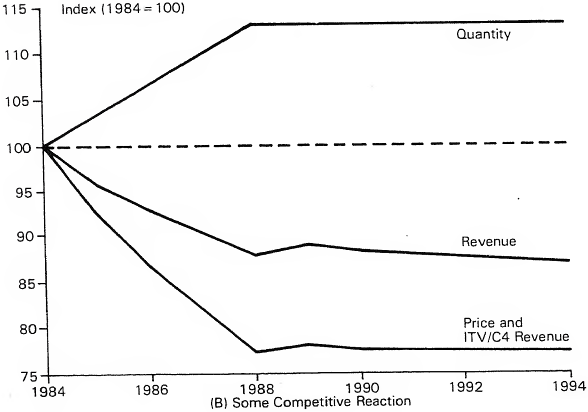


(B) Some Competitive Reaction

Figure 3:
TV Advertising – Gradual Introduction

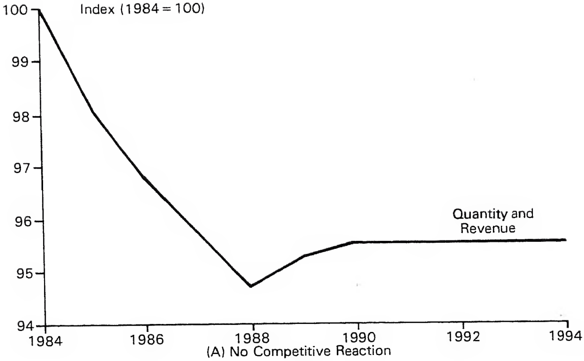


(A) No Competitive Reaction

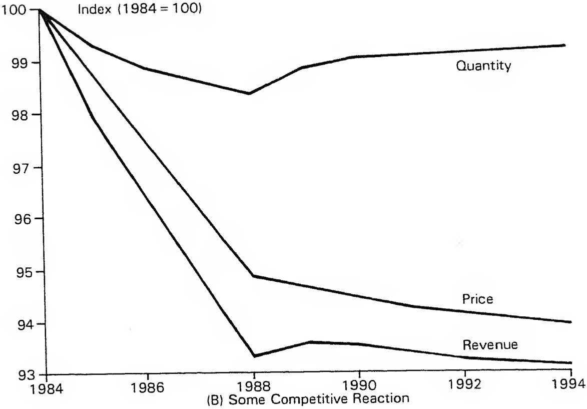


(B) Some Competitive Reaction

Figure 4:
Press Advertising – Gradual

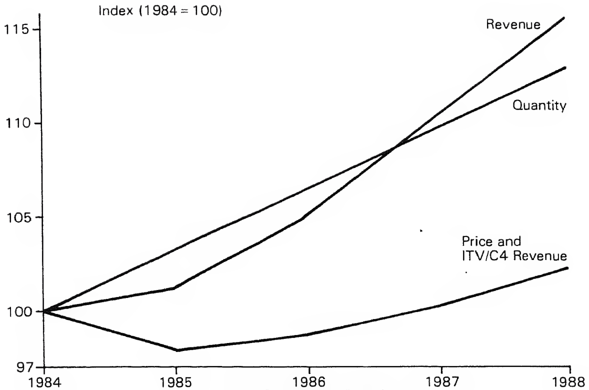


(A) No Competitive Reaction

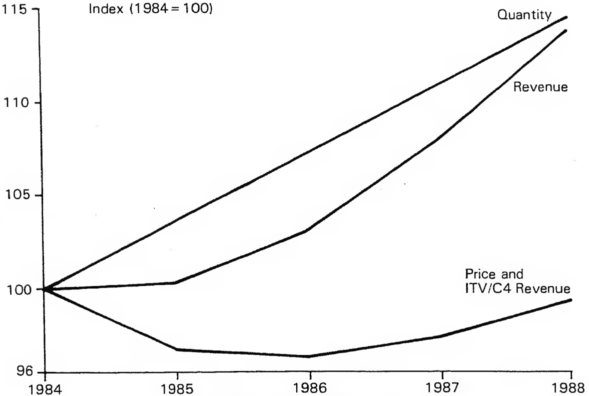


(B) Some Competitive Reaction

Figure 5:
Television Advertising –
Gradual + GNP Growth



(A) No Competitive Reaction



(B) Some Competitive Reaction

The short run effects on price and revenue are really quite large, with price falling by some 25 per cent, and revenues by some 15 per cent. There is considerable overshooting, however, and within three years price has risen back to only about 15 per cent below its initial value, and revenue recovers to only about 4 per cent below its initial value. This overshooting and recovery is a consequence of any demand equation with a reasonably large coefficient on the lagged endogenous variable.

Figure 1b shows the paths for TV advertising prices and revenues allowing for competitive reaction in press advertising prices. Here the short run effects on price and revenue are slightly greater at 27 and 15 per cent respectively; some of the competitive reaction is contemporaneous, after all. Moreover, and this is really the key point, there is little recovery in the long term; the process of mutually competitive price reductions means that the recovery is short lived.

Figure 2a shows the corresponding path for press advertising revenues assuming no competitive reaction (there is therefore no change to the press advertising price). The effect here is rather smaller, with quantities and revenues reduced by about 7 per cent in the short run, from which there is some recovery. Figure 2b shows the paths for press advertising prices and revenues allowing for competitive reaction. The short run effects are a 3 per cent reduction in quantity, a 5 per cent reduction in price, and a 7 per cent reduction in revenues; there is little recovery in this case.

Figures 3(a,b) and 4(a,b) show the corresponding projections when advertising is introduced gradually, with 15 seconds per hour on BBC1 and 2 in 1985, rising steadily to 1 minute per hour in 1988. The main point to note here is that the short term damage to revenues is (as would be expected) less serious, but the long-term effects are essentially the same.

Figures 5(a,b) show the (shorter) projections for TV prices and revenues, when the gradual introduction of advertising on BBC1 and BBC2 is accompanied by a 2 per cent growth of GNP per annum. In the absence of competitive reaction from the press, the growth of GNP is more than sufficient to absorb the introduction of advertising by 1987 (Fig 5a), but with some competitive reaction this process takes a little longer (Fig 5b).

The projections in Figure 5 naturally lead us to ask: For any given growth rate for GNP, what rate of growth of advertising can the market absorb without depressing prices? The answer to this question depends on the long run income elasticity of demand for advertising as measured in 1.1 b(ii) above. For the full model, this long run elasticity is about 2.3 (for the parsimonious model it is about 1.7). If it is appropriate to extrapolate in such a way, this would imply that a steady growth of η per cent in GNP will absorb a steady state growth in TV advertising supply of 2.3η per cent, without depressing TV advertising prices. It is important to remember, of course, that this is a statement about compatible steady state growth paths, and abstracts from the short-term damage done to revenues as described in the projections above.

Finally, we would issue two further caveats about these projections. First, the levels of advertising reached by this increase in supply are beyond anything that has been experienced to date, and in that sense we are extrapolating the model beyond the range of data in the sample period. Nevertheless, the prices projected (in real terms as well as nominal) are well within the range of prices observed during the sample period used for estimation, and in that sense, the problem of extrapolation is not perhaps as serious as appears at first sight. It is sometimes argued that the lower prices that would result from the increase in supply would create demand from advertisers who had never been able to afford the real prices observed to date. Our results suggest that rather more than one minute per hour is required before this argument could apply.

Second, it is worth adding that projections based on the parsimonious estimate for the TV advertising equation suggest even greater damage to TV and press revenues in all cases.

2. A Comparison of BBC and ITV Audiences and their Economic Value

One of the most important assumptions underlying the projections of the first part of this paper was that the range of available BBC audiences was not of a different character to the range of ITV audiences. The purpose of this second part of the paper is twofold. First, we wish to examine the differences between the BBC and ITV audiences, so that we can determine to what extent these differences might undermine the conclusions of the first part of the paper. Second, we wish to examine the related, though as we shall see, conceptually different issue of whether the BBC audiences are likely to be of greater value to advertisers than the ITV audience.

Section 2.1 describes the background to the operation of the market for television advertising. Section 2.2 describes a theoretical framework, known as the characteristics framework, for analysing the differences in audience composition and their importance for our analysis. Section 2.3 describes the relevant characteristics of an audience from the advertiser's point of view. Finally, Section 2.4 presents the results of our analysis.

2.1 The Market for Commercial Time

The supply side of the market is determined by the audiences generated by different programmes and the quantity of advertising allowed per hour. It therefore comprises a variety of different 'products' defined by the demographic and other characteristics of audiences at different times of day on the two channels which carry advertising. The demand side of the market equally consists of advertisers and their agencies seeking to convey their message to different types of audience.

The market sustains a whole range of information gathering organisations, whose function is to match differentiated supply and differentiated demand. There are of course numerous sources of market research information on buying patterns of particular goods and services. The main source of data on viewing habits is BARB (British Audience Research Board), formed in 1980 by broadcasting organisations and advertising bodies to monitor the size and composition of the audiences of programmes and commercials, and also to supply other information about audience attitudes which is primarily of interest to broadcasters.

The organisation to which BARB has contracted the task of monitoring audiences (AGB)–establishes a representative sample of television homes within which information is collected both on the number of hours the television is operating (and which channel it is tuned to) and on the number of hours of television watched by individuals within the household. The former information is recorded via a meter attached to the set(s) in the household; the latter by a 'people-meter' on which individual viewers in the household (and their guests) record their periods of watching. The sample data are then used to estimate the audience composition for any programme or advertisement. A breakdown into five categories of audience is provided each week by BARB's *Weekly TV Audience Report, Part II: Weekly Schedule of Commercials*. A more detailed breakdown – into 70 categories – is provided for four weeks in each quarter by the *Audience Composition Report* which tracks the audience for each fifteen minute period. Subscribers to BARB can also commission special research on questions of interest to them.

Both sides of the market have access to extremely detailed information about the different types of product in existence – or more precisely have data which can be used to predict what products will be available, since the BARB data are of course ex post, and much (though not all) commercial time is bought ex ante in the form of a fixed spot and subject to uncertainty about the actual audience size and composition. We should therefore expect an equilibrium to emerge in each period in which market clearing prices would be set for each spot and those prices would reflect the characteristics of the audience. An American study by Fournier and Martin (1983) of the price of non-network commercial time in local television stations did indeed find that price was related to a demographic variable for audience composition.

We have not had access to the sort of data needed to replicate the Fournier and Martin study. The reason for this is in part the nature of contracts used to buy commercial time. Some time is bought in individual spots according to the 'pre-empt' auction described in a previous paper – Cave (1985). However, many contracts for the sale of commercial time specify not the precise time of transmission of the advertisement, but aim to achieve a specified total audience, in a variable number of transmissions. The television company then has a discretion, determined within the contract, to exhibit the advertisement at various times within a particular hour, day, or week. The effect of this system is to make it impossible to associate a particular price with a particular spot.

The unit in which the audience size in a contract is specified is typically the TVR or television rating. One TVR represents one per cent of the total audience in a particular category, which is almost invariably adults or housewives.

This form of contract suggests that the details of audience composition play at best a small role in determining the price of commercial time. It is also argued that advertisers' ignorance of the finer points of audience composition discourages extensive price differentiation. Advertisers, it is suggested, judge the skill of their agencies in buying time simply on the basis of the 'cost-per-thousand'. The agencies thus lack a strong incentive to buy time which matches their clients detailed needs, if doing so causes the cost-per-thousand to rise.

Nonetheless, in a market with heterogeneous products and quality differences, it is not necessary for all participants to have perfect knowledge of what is available for an equilibrium set of prices to emerge which does reflect quality differences. Certain advertisers clearly seek audiences of a particular kind, and in addition to the American study mentioned above, there is some limited British evidence that cost-per-thousand does vary with audience characteristics. This might be of little consequence if the audience composition of BBC television channels were the same as that of ITV and Channel 4. We shall see in Section 2.4, however, that there are some differences between the channels. Moreover, differences within individual time bands may be even more significant than differences in the aggregate. The analysis which follows will therefore examine whether advertising on BBC television would make available audiences which are qualitatively different from those of existing commercial services.

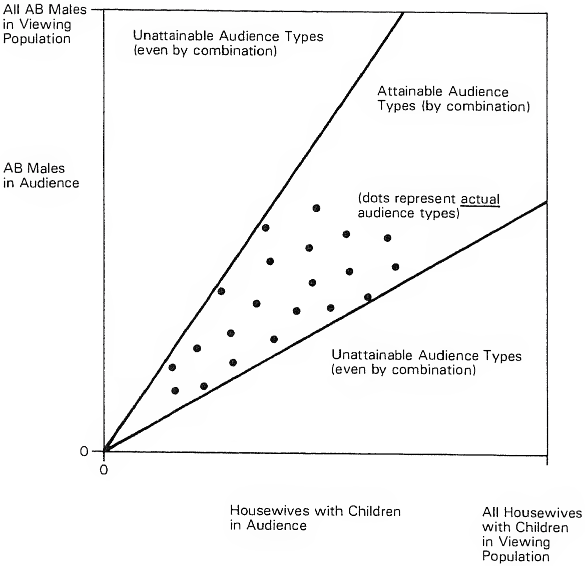
2.2 The Characteristics Framework, Combination of Audiences, and the Diversity of Audience Types

The characteristics approach is the economist's principal tool in the analysis of markets with differentiated products. It is assumed that the group of products can be described by a number of attributes or characteristics, and different products can be compared by the different amounts of each characteristics they contain. In the context of television audiences, we might take two characteristics such as adult males in socioeconomic groups A and B, and housewives with children, and compare the available audiences in terms of the numbers of people in the audience who fall in these two categories. We could then plot a map of the various audiences as in Figure 6; each audience is marked as a point on the map.

The early exponents of the characteristics framework (Gorman (1956), Lancaster (1971), Ironmonger (1972)) paid particular attention to the case where products were divisible and could be combined. An example of this is packets of nails, where it is in principle possible to buy a packet of any quantity from one nail upwards, and where two packets of equal size can be combined to yield a packet containing twice as many nails. It has been generally accepted that most products are neither divisible nor can they be combined in this way, but ironically television audiences are a clear case where audiences can be combined to produce larger audiences, and up to a point are divisible if very short spots can be bought. It should be stressed that the rule of combination is not quite so simple as the additive rule for combining packets of nails – we shall discuss the appropriate rule of combination at the end of this section.

When products can be combined in this way, the characteristics framework offers some very useful insights about when product diversity is of particular value to the market, and when it is not. In this context, we can use the framework to examine whether or not the ranges of BBC audiences and ITV audiences are sufficiently dissimilar to invalidate the aggregate demand analysis in the first part of this paper.

Figure 6


All AB Males in Viewing Population
AB Males in Audience
0
0
Unattainable Audience Types (even by combination)
Attainable Audience Types (by combination)
(dots represent actual audience types)
Unattainable Audience Types (even by combination)
Housewives with Children in Audience
All Housewives with Children in Viewing Population

Referring to Figure 6 again, we could imagine that by appropriate choice of audiences types, it should be possible to combine audiences so as to approximate many (if not all) audiences in the triangle shown. We cannot approximate audiences outside this triangle because none of the individual audiences offer characteristics in such proportions.

Imagine that the range of points shown represent ITV and Channel 4 audiences, and the triangle shows all the constructed audiences that can be reached. Now we can analyse whether the introduction of advertising on the BBC channels would introduce audiences of a qualitatively different type, or whether they would simply constitute more of the same – or at any rate, more of what can be reached by combining individual audiences. If any BBC audience lies outside the triangle – it doesn't matter how far from the origin – then that audience is qualitatively different from available ITV audiences, and it is misleading to treat the addition of that audience to the market as simply more of the same. Moreover, if such audiences exist in some numbers, then the 'products' are sufficiently differentiated that they need not be very close substitutes, and consequently their prices need not necessarily move together – as we assumed in Part 1. If, on the other hand, the majority of BBC audiences lie within the triangle, then they are just more of the same (within this limited characteristics map), and then the analysis in Part 1 is not too misleading.

Note that there is no assumption whatever that all audiences within the triangle are worth the same, nor even that all audiences within the triangle of equal total size are worth the same irrespective of the relative proportions in which they offer characteristics. Moreover, even if the average BBC audience is somewhat different from the average ITV audience, that in itself need not invalidate the analysis in the first part of the paper, though it could quite possibly imply that BBC audiences are viewer for viewer worth more (or less) than ITV audiences, and in the projections above, the introduction of advertising on the BBC would amount to a greater increase in supply than the original calculation suggested.

Naturally, we would want to extend this analysis to many more characteristics than the two considered here. This can be done, though some technical issues need to be addressed. Speaking technically, the multi-dimensional equivalent of the triangle in Figure 6 is the convex closure of the extended set of audience vectors in characteristics space. In obtaining the results presented in Section 2.4, we have not computed this exactly, but used what should in most circumstances be a reasonable approximation.

There remains the question of how exactly audiences can be combined. The reason why two exposures of an advertisement to two audiences of half a million people will not necessarily achieve the same result as one exposure to an audience of a million is simply that (unless the advertisements are broadcast back to back on rival channels) a number of people will see both exposures, and the total 'reach' is accordingly less than a million. Figure 7 shows how total reach increases as a function of the number of exposures for audiences of different sizes, assuming that all viewers watch television for the same number of hours per week – comparable graphs can be drawn when this assumption is not appropriate. It shows very clearly how diminishing returns set in when a sizeable proportion of the population have already been reached.

Figure 8 gives a rather better impression of the relative efficiency of small numbers of exposures to large audiences and large numbers of exposures to small audiences. For a given total rating of 30 per cent, it shows the total reach from n exposures to a proportion $0.3/n$ of the viewing population. It also shows a 'diversity-adjusted' measure of efficiency in reach which takes account of the fact that in the viewing population some are heavy viewers and others are light viewers, and uses a typical distribution of viewing weights (ADMAP October 1984, p.454). The figure shows how the large audience is somewhat more efficient than many small audiences.

The conclusion is that audiences can be combined to reach larger audiences, even though the rule of combination is not exactly additive. All this means is that large audiences command a premium from the advertiser to reflect their relative efficiency, but they are not qualitatively different in terms of the perspective we have adopted in this section.

Figure 7
Reach as a Function of Number of Broadcasts for Audiences of Different Sizes

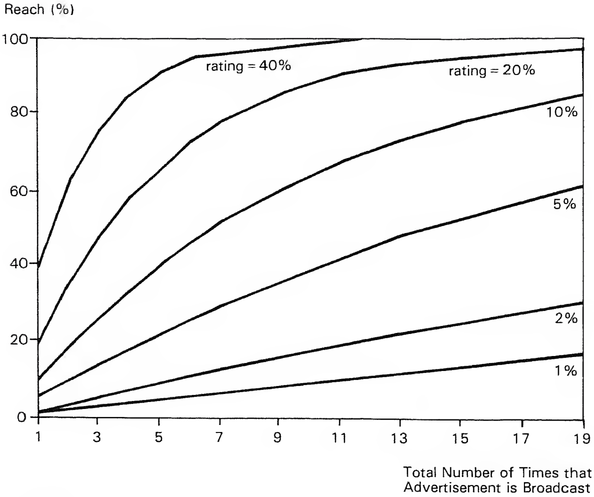
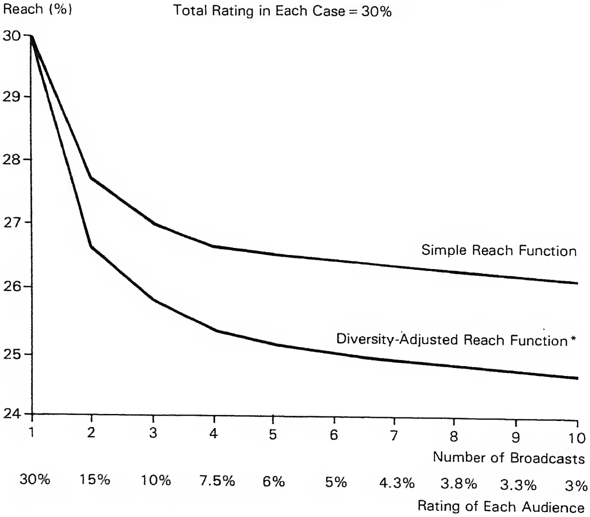


Figure 8
Comparative Efficiency of a Few Large and Many Small Audiences



*The diversity-adjusted function uses data on the observed diversity in weight of viewing – see text.

2.3 **Relevant Audience Characteristics**

Three types of audience characteristic are of interest in this analysis: first, sheer size of audience; second, demographic properties; and third, viewing habits.

(i) Audience Size

Advertisers are interested not only in the total rating they achieve, but also in the distribution of exposures to the advertisement across the target audience as measured by reach and frequency. Reach is the proportion of the target audience that has seen the advertisement at least *n* times, where *n* is the frequency. The optimal frequency for a particular campaign varies with the nature of the product and the relevant time period over which it is planned. Below a certain frequency, advertising has little effect, while beyond a certain point, additional frequency is likely to run into diminishing or even negative returns. For this reason, it is desirable for the efficiency of a campaign that the distribution of exposures across the target audience has a relatively low variance so that the majority of the audience receive close to the optimum frequency of advertisements.

Given that the distribution of exposures is a binomial, it is easy to show that the variance of the distribution (for a given total rating) is given by: total rating × (1 – rating of each individual audience). Then it is clear that the larger the audience for each individual programme, the smaller the variance of exposures amongst the audience, and the more efficient the campaign.

This is another aspect of what we saw in the previous section, namely that there is less danger of overlap in a few relatively large audiences than in a larger number of relatively small audiences. Accordingly, the large audience commands a disproportionately large premium. The precise size of this premium depends on the shape of the advertising response function, showing the influence of an advertising campaign on a particular consumer as a function of the number of exposures. As a simple (and rather unrealistic) example, suppose that the optimum frequency is one, and higher frequencies have no additional effect. Then the diversity adjusted curve in Figure 7 above suggests that one audience with a rating of 30 per cent is worth some 20 per cent more than 10 audiences with ratings of 3 per cent each, because in the latter case the total reach is only 25 per cent of the population.

The disproportionate premium that can be earned by the large audience is visible both in the structure of the rate card, and in industry data relating size to actual price paid.

(ii) Demographic Composition

It is commonplace that young men buy most beer while housewives buy most nappies. Moving to less obvious examples, there is extensive market research on the buying habits of different demographic groups. Accordingly, we could expect the precise demographic composition of an audience to be of interest to some advertisers, though as mentioned in Section 2.1, not necessarily to all.

In our study we have paid particular attention to the following twelve demographic categories, which are some of the categories most widely used in market research studies, and – we are told – most widely considered by advertisers themselves:

1) Adults; ABC1; 16-34
2) Adults; ABC1; 35-54
3) Adults; ABC1; 55+
4) Adults; C2DE; 16-34
5) Adults; C2DE; 35-54
6) Adults; C2DE; 55+
7) Housewives; 16-34
8) Housewives; 35+
9) Housewives; With Children
10) Housewives; Without Children
11) Men; AB
12) Individuals; 16-24

We should emphasise that these categories are not all mutually exclusive. Moreover, the BARB data offer many more categories than these. Nevertheless, we consider that they are a suitable group for an exploratory analysis.

(iii) Viewing Habits

The above discussion of reach and frequency implies that a special value may attach to individuals who are infrequently exposed to television commercials. The BARB Audience Composition Report distinguishes such viewers as 'light ITV viewers', and we have made use of this as a final audience characteristic. Light ITV viewers may either be light viewers of television in general, or viewers who exhibit loyalty to a BBC channel. (Audience research in the 1970's, when there were three channels, found that the probability of a viewer watching two programmes on different days of the week, or in different weeks, was approximately twice as great if both programmes were on the same channel than if one were on ITV and the other on a BBC channel – Goodhartd, Ehrenberg and Collins (1975). For these reasons BBC audiences may contain a disproportionate share of light ITV viewers.

It is worth noting, however, that any premium that may attach to light ITV viewers derives from the difficulty of reaching them with present television advertising, and that premium would be eroded if advertising were widespread on the BBC. The independent value of this characteristic thus depends strictly on there being only limited advertising on the BBC.

2.4 **The Results**

As we have argued before we wish to answer two questions about the differences between BBC and ITV audiences. First, is the *average* audience composition different in any important way? If for example BBC audiences contain on average a disproportionately large number of AB males (who have high spending power) this could make these audiences of particular value. Second, are the *ranges* of audience types different in any important sense? If so, then this would cast doubt on the projections in Part 1, which assumed that the introduction of some advertising on BBC channels could be taken to be equivalent to some increase in the supply of advertising on ITV and Channel 4 – though the precise relative weights would depend on when the advertisements were transmitted.

To answer the first question is relatively easy. We need only look at the average audience sizes of the different channels, and their average demographic composition. Table 2 shows the average audience sizes during peak time (18.00–24.00) on the four channels on a weekday, a Saturday, and a Sunday. The precise figures are averages for the period of 3rd to 30th June 1985; the weekday figure is an average of all weekdays during that period, the Saturday figure an average of all four Saturdays, and the Sunday figure an average of all four Sundays. The table shows what is generally well known, namely that the league table of average audiences is: ITV, BBC1, BBC2, Channel 4.

Table 2
Average audiences
(3rd to 30th June, 1985)

	Weekday ('000)	%	Saturday ('000)	%	Sunday ('000)	%	All days ('000)	%
ITV	9106	47%	8771	43%	6952	37%	8750	45%
C4	1472	8%	711	4%	1450	8%	1360	7%
ITV+C4	10578	54%	9482	47%	8402	45%	10111	52%
BBC1	6473	33%	8392	41%	7254	39%	6859	35%
BBC2	2424	12%	2379	12%	3074	16%	2510	13%
BBC1+2	8897	46%	10771	53%	10328	55%	9369	48%
TOTAL	19475	100%	20253	100%	18730	100%	19480	100%

Table 3 shows the average audience composition during peak time – in terms of the average proportions falling into the thirteen categories. Again, the averages (average number in each category divided by average total audience for that channel) apply to the period 3rd to 30th June 1985, and as before separate averages are presented for weekdays, Saturdays and Sundays. The main points to note are as follows. Generally, though not invariably, BBC1 and BBC2 audiences have higher proportions of ABC1 adults than ITV audiences, though not necessarily higher than C4 audiences. Likewise, ITV audiences tend to have higher proportions of C2DE adults than the rest. BBC2 seems to attract the highest proportion of AB males, while there is no corresponding generalisation for housewives. Finally, as expected, BBC1 and especially BBC2 do have a much larger proportion of light ITV viewers than ITV, though perhaps surprisingly, the average proportion for BBC1 is actually lower than the average proportion for C4 on Saturdays.

Table 3
Average proportions of viewing audience

	ADULTS												
	ABC1			C2DE			HOUSEWIVES				MEN	INDS	LGT
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
WEEKDAY													
C4	0.08	0.11	0.06	0.19	0.17	0.24	0.12	0.34	0.15	0.30	0.05	0.10	0.11
ITV	0.06	0.08	0.08	0.16	0.17	0.32	0.10	0.40	0.13	0.36	0.04	0.09	0.04
BBC1	0.09	0.12	0.08	0.16	0.16	0.25	0.11	0.36	0.15	0.32	0.06	0.10	0.16
BBC2	0.08	0.13	0.09	0.15	0.15	0.26	0.09	0.37	0.12	0.34	0.07	0.09	0.19
SATURDAY													
C4	0.08	0.11	0.10	0.15	0.14	0.31	0.08	0.39	0.10	0.37	0.07	0.11	0.13
ITV	0.07	0.09	0.06	0.19	0.18	0.25	0.10	0.32	0.14	0.28	0.04	0.09	0.05
BBC1	0.08	0.10	0.07	0.15	0.16	0.27	0.26	0.19	0.13	0.32	0.05	0.08	0.12
BBC2	0.08	0.15	0.10	0.13	0.15	0.26	0.08	0.37	0.11	0.34	0.08	0.07	0.20
SUNDAY													
C4	0.08	0.13	0.09	0.16	0.20	0.26	0.10	0.39	0.14	0.34	0.06	0.09	0.12
ITV	0.07	0.10	0.07	0.17	0.18	0.29	0.11	0.38	0.14	0.36	0.04	0.09	0.04
BBC1	0.08	0.12	0.10	0.14	0.17	0.29	0.08	0.38	0.12	0.35	0.07	0.08	0.16
BBC2	0.10	0.14	0.08	0.18	0.19	0.24	0.11	0.35	0.14	0.32	0.08	0.10	0.18

To answer the second question is harder, for as we saw in Section 2.2, we need to compute the many-characteristic equivalent of the triangle in Figure 5. As we noted before, this becomes a rather complex calculation, and for the purposes of this exploratory analysis, we have used an approximation.

The essence of the approximation is to compute for each channel in turn, and for each fifteen minute slot during the typical day (or, to be precise, during peak time) the proportion of the audience that falls into each of the thirteen audience categories during that time slot. Then for each channel, and each audience category, we find the maximum and minimum proportions. This set of maxima and minima describe the variety of audiences on each channel on a typical day. We can then compare BBC and ITV audiences by comparing the sets of maxima and minima. In particular, if the maxima and minima for each audience characteristic for both BBC channels lie within the combined range of ITV and Channel 4, then (subject to the approximation implicit in this simplified technique) the BBC channels do not offer a qualitatively different range of audience types to those already on offer from ITV and Channel 4. If, on the other hand, the maxima and minima for BBC channels do not lie within this combined range, then to a greater or lesser degree, the range of BBC audiences is qualitatively different.

Tables 4 to 6 summarise these maxima and minima for the four channels on the typical weekday, the typical Saturday, and the typical Sunday, and Table 7 summarises the maxima and minima for each channel over the three typical days. (As before, the typical days are averages of all weekdays, Saturdays and Sundays respectively, over the period 3rd to 30th June, 1985.) The tables also present combined maxima for the two independent channels and for the two BBC channels. Finally, the tables present the combined maxima and minima that are obtained when the range of audience types on BBC1 alone, BBC2 alone, or both BBC1 and BBC2 are added to the range of audience types on the two independent channels combined.

Table 4
Max/min proportions of different characteristics – weekday

	ADULTS												
	ABC1			C2DE			HOUSEWIVES				MEN	INDS	LGT
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
C4													
max	0.10	0.16	0.14	0.25	0.21	0.35	0.18	0.44	0.18	0.40	0.09	0.17	0.20
min	0.06	0.08	0.03	0.09	0.13	0.16	0.06	0.25	0.08	0.23	0.04	0.03	0.09
ITV													
max	0.08	0.13	0.10	0.21	0.23	0.40	0.12	0.45	0.17	0.42	0.06	0.12	0.09
min	0.05	0.01	0.06	0.15	0.14	0.24	0.09	0.35	0.11	0.30	0.03	0.08	0.02
INDEPENDENT TELEVISION													
max	0.10	0.16	0.14	0.25	0.23	0.40	0.18	0.45	0.18	0.42	0.09	0.17	0.20
min	0.05	0.01	0.03	0.09	0.13	0.16	0.06	0.25	0.08	0.23	0.03	0.03	0.02
BBC1													
max	0.11	0.15	0.12	0.21	0.22	0.31	0.13	0.42	0.18	0.38	0.07	0.13	0.25
min	0.08	0.11	0.06	0.12	0.15	0.19	0.07	0.24	0.11	0.28	0.05	0.08	0.11
BBC2													
max	0.10	0.20	0.15	0.19	0.18	0.33	0.11	0.45	0.15	0.41	0.13	0.12	0.24
min	0.08	0.09	0.07	0.10	0.12	0.16	0.07	0.31	0.10	0.30	0.06	0.06	0.15
BBC TELEVISION													
max	0.11	0.20	0.15	0.21	0.22	0.33	0.13	0.45	0.18	0.41	0.13	0.13	0.25
min	0.08	0.09	0.06	0.10	0.12	0.16	0.07	0.24	0.10	0.28	0.05	0.06	0.11
INDEPENDENT + BBC1													
max	0.11	0.16	0.14	0.25	0.23	0.40	0.18	0.45	0.18	0.42	0.09	0.17	0.25
min	0.05	0.01	0.03	0.09	0.13	0.16	0.06	0.24	0.08	0.23	0.03	0.03	0.02
INDEPENDENT + BBC2													
max	0.10	0.20	0.15	0.25	0.23	0.40	0.18	0.45	0.18	0.42	0.13	0.17	0.24
min	0.05	0.01	0.03	0.09	0.12	0.16	0.06	0.25	0.08	0.23	0.03	0.03	0.02
ALL CHANNELS													
max	0.11	0.20	0.15	0.25	0.23	0.40	0.18	0.45	0.18	0.42	0.13	0.17	0.25
min	0.05	0.01	0.03	0.09	0.12	0.16	0.06	0.24	0.08	0.23	0.03	0.03	0.02

Table 5
Max/min proportions of different characteristics – Saturday

	ADULTS												
	ABC1			C2DE			HOUSEWIVES				MEN	INDS	LGT
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
C4													
max	0.16	0.19	0.16	0.33	0.19	0.50	0.14	0.71	0.15	0.69	0.14	0.29	0.21
min	0.05	0.07	0.03	0.05	0.08	0.12	0.05	0.23	0.05	0.24	0.03	0.04	0.08
ITV													
max	0.10	0.13	0.08	0.56	0.22	0.13	0.13	0.37	0.18	0.32	0.07	0.13	0.07
min	0.06	0.07	0.04	0.16	0.17	0.09	0.09	0.29	0.02	0.25	0.04	0.08	0.04
INDEPENDENT TELEVISION													
max	0.16	0.19	0.16	0.56	0.22	0.50	0.14	0.71	0.18	0.69	0.14	0.29	0.21
min	0.05	0.07	0.03	0.05	0.08	0.09	0.05	0.23	0.02	0.24	0.03	0.04	0.04
BBC1													
max	0.10	0.12	0.11	0.19	0.21	0.34	0.33	0.24	0.15	0.40	0.07	0.11	0.17
min	0.07	0.09	0.05	0.12	0.14	0.21	0.22	0.10	0.10	0.26	0.04	0.06	0.11
BBC2													
max	0.12	0.20	0.18	0.21	0.19	0.37	0.13	0.48	0.17	0.46	0.10	0.10	0.33
min	0.06	0.07	0.07	0.07	0.10	0.18	0.04	0.27	0.05	0.26	0.05	0.05	0.11

Table 5
Max/min proportions of different characteristics – Saturday (contd.)

	ADULTS ABC1			C2DE			HOUSEWIVES				MEN	INDS	LGT
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
BBC TELEVISION													
max	0.12	0.20	0.18	0.21	0.21	0.37	0.33	0.48	0.17	0.46	0.10	0.11	0.33
min	0.06	0.07	0.05	0.07	0.10	0.18	0.04	0.10	0.05	0.26	0.04	0.05	0.11
INDEPENDENT + BBC1													
max	0.16	0.19	0.16	0.56	0.22	0.50	0.33	0.71	0.18	0.69	0.14	0.29	0.21
min	0.05	0.07	0.03	0.05	0.08	0.09	0.05	0.10	0.02	0.24	0.03	0.04	0.04
INDEPENDENT + BBC2													
max	0.16	0.20	0.18	0.56	0.22	0.50	0.14	0.71	0.18	0.69	0.14	0.29	0.33
min	0.05	0.07	0.03	0.05	0.08	0.09	0.04	0.23	0.02	0.24	0.03	0.04	0.04
ALL CHANNELS													
max	0.16	0.20	0.18	0.56	0.22	0.50	0.33	0.71	0.18	0.69	0.14	0.29	0.33
min	0.05	0.07	0.03	0.05	0.08	0.09	0.04	0.10	0.02	0.24	0.03	0.04	0.04

Table 6
Max/min proportions of different characteristics – Sunday

	ADULTS ABC1			C2DE			HOUSEWIVES				MEN	INDS	LGT
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
C4													
max	0.11	0.19	0.17	0.23	0.26	0.35	0.13	0.48	0.16	0.43	0.10	0.14	0.23
min	0.05	0.07	0.04	0.07	0.12	0.16	0.06	0.28	0.10	0.24	0.04	0.04	0.06
ITV													
max	0.10	0.13	0.10	0.22	0.24	0.42	0.14	0.47	0.18	0.68	0.06	0.13	0.06
min	0.04	0.06	0.04	0.12	0.15	0.18	0.07	0.29	0.10	0.20	0.03	0.06	0.03
INDEPENDENT TELEVISION													
max	0.11	0.19	0.17	0.23	0.26	0.42	0.14	0.48	0.18	0.68	0.10	0.14	0.23
min	0.04	0.06	0.04	0.07	0.12	0.16	0.06	0.28	0.10	0.20	0.03	0.04	0.03
BBC1													
max	0.10	0.16	0.15	0.17	0.20	0.38	0.10	0.48	0.14	0.43	0.08	0.10	0.20
min	0.04	0.11	0.08	0.08	0.12	0.23	0.03	0.32	0.09	0.29	0.05	0.04	0.13
BBC2													
max	0.13	0.15	0.14	0.24	0.23	0.39	0.14	0.53	0.18	0.50	0.10	0.14	0.31
min	0.05	0.10	0.03	0.08	0.14	0.19	0.06	0.30	0.09	0.27	0.05	0.04	0.11
BBC TELEVISION													
max	0.13	0.16	0.15	0.24	0.23	0.39	0.14	0.53	0.18	0.50	0.10	0.14	0.31
min	0.04	0.10	0.03	0.08	0.12	0.19	0.03	0.30	0.09	0.27	0.05	0.04	0.11
INDEPENDENT + BBC1													
max	0.11	0.19	0.17	0.23	0.26	0.42	0.14	0.48	0.18	0.68	0.10	0.14	0.23
min	0.04	0.06	0.04	0.07	0.12	0.16	0.03	0.28	0.09	0.20	0.03	0.04	0.03
INDEPENDENT + BBC2													
max	0.13	0.19	0.17	0.24	0.26	0.42	0.14	0.53	0.18	0.68	0.10	0.14	0.31
min	0.04	0.06	0.03	0.07	0.12	0.16	0.06	0.28	0.09	0.20	0.03	0.04	0.03
ALL CHANNELS													
max	0.13	0.19	0.17	0.24	0.26	0.42	0.14	0.53	0.18	0.68	0.10	0.14	0.31
min	0.04	0.06	0.03	0.07	0.12	0.16	0.03	0.28	0.09	0.20	0.03	0.04	0.03

Table 7
Max/min proportions of different characteristics – all days

	ADULTS						HOUSEWIVES				MEN	INDS	LGT
	ABC1			C2DE									
	16–	35–	55+	16–	35–	55+	16–	35+	WITH	W'OUT	AB	16–	VWRS
C4													
max	0.16	0.19	0.17	0.33	0.26	0.50	0.18	0.71	0.18	0.69	0.14	0.29	0.23
min	0.05	0.07	0.03	0.05	0.08	0.12	0.05	0.23	0.05	0.23	0.03	0.03	0.06
ITV													
max	0.10	0.13	0.10	0.56	0.24	0.42	0.14	0.47	0.18	0.68	0.07	0.13	0.09
min	0.04	0.01	0.04	0.12	0.14	0.09	0.07	0.29	0.02	0.20	0.03	0.06	0.02
INDEPENDENT TELEVISION													
max	0.16	0.19	0.17	0.56	0.26	0.50	0.18	0.71	0.18	0.69	0.14	0.29	0.23
min	0.04	0.01	0.03	0.05	0.08	0.09	0.05	0.23	0.02	0.20	0.03	0.03	0.02
BBC1													
max	0.11	0.16	0.15	0.21	0.22	0.38	0.33	0.48	0.18	0.43	0.08	0.13	0.25
min	0.04	0.09	0.05	0.08	0.12	0.19	0.03	0.10	0.09	0.26	0.04	0.04	0.11
BBC2													
max	0.13	0.20	0.18	0.24	0.23	0.39	0.14	0.53	0.18	0.50	0.13	0.14	0.33
min	0.05	0.07	0.03	0.07	0.10	0.16	0.04	0.27	0.05	0.26	0.05	0.04	0.11
BBC TELEVISION													
max	0.13	0.20	0.18	0.24	0.23	0.39	0.33	0.53	0.18	0.50	0.13	0.14	0.33
min	0.04	0.07	0.03	0.07	0.10	0.16	0.03	0.10	0.05	0.26	0.04	0.04	0.11
INDEPENDENT + BBC1													
max	0.16	0.19	0.17	0.56	0.26	0.50	0.33	0.71	0.18	0.69	0.14	0.29	0.25
min	0.04	0.01	0.03	0.05	0.08	0.09	0.03	0.10	0.02	0.20	0.03	0.03	0.02
INDEPENDENT + BBC2													
max	0.16	0.20	0.18	0.56	0.26	0.50	0.18	0.71	0.18	0.69	0.14	0.29	0.33
min	0.04	0.01	0.03	0.05	0.08	0.09	0.04	0.23	0.02	0.20	0.03	0.03	0.02
ALL CHANNELS													
max	0.16	0.20	0.18	0.56	0.26	0.50	0.33	0.71	0.18	0.69	0.14	0.29	0.33
min	0.04	0.01	0.03	0.05	0.08	0.09	0.03	0.10	0.02	0.20	0.03	0.03	0.02

The sheer mass of numbers in these tables may be a little overwhelming, but we can summarise the main points to emerge from comparing the range of audiences available on all channels combined with those available on the two independent channels combined. On the typical weekday, the addition of BBC1 and BBC2 would introduce some audiences with slightly higher proportions of ABC1 adults (all age groups), AB males, and light ITV viewers, but the range of available audience types is not extended all that much. On the typical Saturday, this addition would introduce audiences with very slightly higher proportions of ABC1 adults (35-54 and 55+), perversely perhaps much higher proportions of young housewives, and as expected audiences with a much greater proportion of light ITV viewers. On the typical Sunday, there would be audiences with slightly higher proportions of ABC1 adults (16-34 only) and (surprisingly) C2DE adults (16-34 only), as well as older housewives, and (again as expected) light viewers.

Taking an overall view over the three typical days, there would be only two significant additions to the range of available audience types: first, the much higher proportion of young housewives (this was noted above, and there must be some doubt as to whether this is a general result, or one that reflects a particular programme being shown at that time); and second, the much higher proportion of light ITV viewers. There would also be audiences with very slightly higher proportions of ABC1 adults (35-54 and 55+), but this is all.

It may be that this overall view is the most appropriate, as the range of audience types should be a range over many days rather than just a typical day; by that token of course, we would like to compute maxima and minima over individual days rather than averages – something that is not possible with the BARB data as presented. If this line of argument is correct, the results above suggest that apart from the addition of audiences with higher proportions of light ITV viewers, and a somewhat surprising finding about young housewives, the extension of advertising to the BBC would not offer a much broader range of audience types. We should say, of course, that by considering enough characteristics it should be possible to make audiences appear to be extreme points in this space; in exactly the same way, we find with the analytically similar techniques of measuring product competitiveness and productive efficiency that if enough characteristics are taken, it is usually possible to make most products (productive activities) appear competitive (efficient) – see Swann (1985a).

One final summary technique may be useful. We can show (though the mathematics are omitted here) that the approximation to the multidimensional convex closure referred to in Section 2.2 has a size roughly proportional to the product of the ranges of each audience characteristic; that is, the product of maximum less minimum for each of the thirteen characteristics. Loosely speaking, we might refer to these products as 'diversity measures'.

Table 8 shows the diversity measures corresponding to the ranges of audience types summarised in Tables 4 to 7. The units are difficult to interpret, and the fact that the audience characteristics used are not mutually exclusive may lead to a certain amount of double counting. Nevertheless, it is possible to make a rough estimate of the additional diversity by taking the difference between the combined BBC/Independent range measure and the Independent range measure. These differences are described as the 'values' of the extended range of audience types, though it must be remembered that this is a measure of increased diversity rather than economic value per se. Taking the figures for all days, it is surprising to find that it is the addition of BBC1 rather than BBC2 which would increase the diversity by the greatest amount – though again, we must stress that this is the result of what we suspect may be an atypical observation.

Table 8
Relative diversity measures for channel audiences log(10) scale: ITV (Saturday) = 0

	Weekday	Saturday	Sunday	All days
C4	3.31	6.05	3.72	6.71
ITV	0.26	0.00	2.13	3.98
INDEPENDENT	4.25	6.77	4.68	7.43
BBC1	0.67	0.43	1.26	3.93
BBC2	1.18	3.62	3.59	4.96
BBC	2.66	4.70	3.98	5.76
IND + BBC1	4.45	7.37	4.87	7.94
IND + BBC2	4.74	7.15	5.14	7.69
ALL CHANNELS	4.86	7.71	5.28	8.12
'VALUE' OF ADDING:				
BBC1 ONLY	0.21	0.60	0.19	0.51
BBC2 ONLY	0.49	0.37	0.46	0.25
BOTH	0.61	0.94	0.60	0.69

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